

## Southern African Journal of Policy and Development

Volume 2

Number 1 October 2015

Article 6

# The Impact of Labour Productivity on Economic Growth: The Case of Mauritius and South Africa

Jack Jones Zulu

*Economic Commission for Africa*

Benjamin Mattondo Banda

*Economic Commission for Africa*

Follow this and additional works at: <https://scholarship.law.cornell.edu/sajpd>

 Part of the [African Studies Commons](#), [Growth and Development Commons](#), and the [Labor Economics Commons](#)

### Recommended Citation

Zulu, Jack Jones and Banda, Benjamin Mattondo (2015) "The Impact of Labour Productivity on Economic Growth: The Case of Mauritius and South Africa," *Southern African Journal of Policy and Development*: Vol. 2 : No. 1 , Article 6.

Available at: <https://scholarship.law.cornell.edu/sajpd/vol2/iss1/6>

This Article is brought to you for free and open access by the Journals at Scholarship@Cornell Law: A Digital Repository. It has been accepted for inclusion in Southern African Journal of Policy and Development by an authorized editor of Scholarship@Cornell Law: A Digital Repository. For more information, please contact [jmp8@cornell.edu](mailto:jmp8@cornell.edu).

## **The Impact of Labour Productivity on Economic Growth: The Case of Mauritius and South Africa**

*Jack Jones Zulu and Benjamin Mattondo Banda \**

*(Economic Commission for Africa, Addis Ababa, Ethiopia)*

---

*This study explores the impact of labour productivity on economic growth in Mauritius and South Africa. We establish that investments in physical capital have a positive effect on labour productivity and by implication on economic performance. Labour employment in industry is counterproductive, while the cumulative effect of new technologies on labour productivity is negligible in the three-year intervals. It is the initial stock and subsequent accumulation of human capital that stimulates faster output growth in both countries.*

---

### **1. Introduction**

Several studies demonstrate the positive effects of labour productivity on economic growth and development (Campbell, 2009; Kazuya, 2009; Palle et al., 1995; Wu, 2013; Chan et al., 1987). Labour productivity is accorded prominence in standard growth accounting models following Solow (1956). Mankiw, Romer and Weil (1992) essentially validated the standard Solow model and argued for an extended model that includes both physical capital and human capital. Recent studies such as Hall and Jones (1999), Prescott (1998), Ahmad et al. (2010) and Fosse et al. (2014) adopt more flexible growth accounting functional forms to measure the impact of labour productivity on economic growth.

Most studies build their argument on appropriate specifications of structural equations for measuring total factor productivity (TFP) and emphasise the role of technology in explaining growth. In this regard, countries can increase output either through more labour effort or through increases in labour productivity. As labour force growth slows and unemployment remains at relatively low levels, countries must increasingly look to productivity enhancements to maintain high rates of output and income growth (Highfill, 2002). However, no studies specifically analysed countries at similar levels of industrial development but with huge differences in terms of labour endowments.

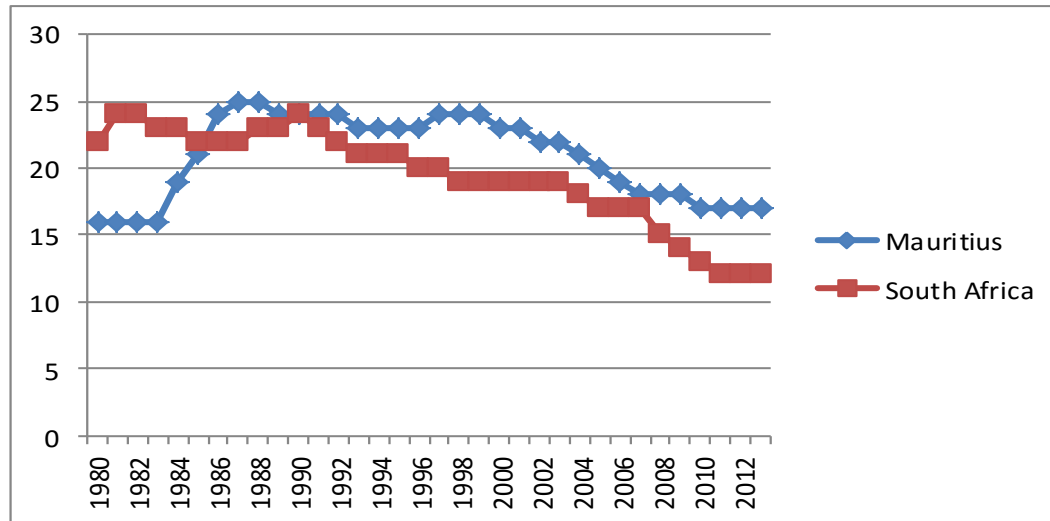
In this paper, we argue that the divergence in gross domestic product (GDP) growth of countries such as Mauritius and South Africa, which are at the same level of industrial

---

\* The opinions expressed in this paper are those of the authors and do not necessarily reflect the views of the Economic Commission for Africa.

development, can be explained by differences in labour endowments and labour productivity. Although manufacturing performance in the two countries has been similar over the years (Figure 1), the economies have different labour employment indicators. We focus on the manufacturing sector because it is a good proxy for levels of industrialisation and also because of the sector's high contribution to gross domestic product in both countries.

**Figure 1: Manufacturing Value Added (% of GDP) for Mauritius and South Africa**



Source: World Bank Database

We also argue that the difference in unemployment rates between the two countries is not just structural, but also a reflection of differences in labour productivity. South Africa, with a nominal GDP of \$349.8 billion in 2014, is the second biggest economy in Africa after Nigeria, but has one of the highest unemployment rates, hovering around 25 percent of the total population and over 50 percent for youth aged between 15-24 years since 2010. In contrast, Mauritius, which relies mainly on tourism and services, recorded a GDP of \$12.6 billion in 2014, with a total unemployment rate of about 8 percent and youth unemployment ranging between 21 and 23 percent since 2010 (World Development Indicators, 2013).

The World Bank (2011) observed from trend data that labour productivity in South Africa was driven predominantly by rising capital intensity, but admitted that a comprehensive assessment was needed to render support to this observation. While some studies argue that higher technology input (capital intensity) leads to higher productivity, we argue that labour productivity is a consequence of investment in human capital that translates into better skills and usage of technology for productive use. This is consistent with arguments by other policy analysts that if African countries are to sustain high economic growth and lift millions of people out of poverty, then they have to make deliberate choices to invest in their abundant human capital through education, training and retooling

to enhance labour productivity and, by implication, raise economic growth (ECA and AU, 2013; ECA and AU, 2014).

Structural changes in South Africa may be more important in explaining unemployment. For instance, it is argued for South Africa that the demand for unskilled labour declined in the agricultural and mining sectors while there was a concurrent increase in the supply of less skilled labour, mostly of African women, into the labour market (Banerjee et al., 2008). Furthermore, the structural shift of skill-biased technical change in South Africa amplifies the unemployment consequences of the increase in supply of unskilled workers. While Mauritius appears to be immune to structural unemployment, its unemployment rate may be driven by business cycles or global trends, affecting mainly tourism and manufacturing. Specialised labour skills and high productivity are needed for countries to maintain international competitiveness. A number of policy levers and strategies were employed by both countries to boost labour productivity as a platform for economic growth. Mauritius aims at becoming a knowledge economy through increased investments in human capital. South Africa uses fiscal incentives, among others to encourage firms to offer training and reskilling of their employees to raise productivity. In addition, both countries have instituted broad economic and labour reforms to promote labour productivity.

It is therefore imperative to investigate, with the support of empirical data, to what extent labour productivity has contributed to economic growth in the two countries. However, long-run growth policymakers in both South Africa and Mauritius would need to understand the consequence of the cumulative skills gap and mismatch, as the economies experience industry-led growth. The present paper effectively demonstrates the link between labour productivity and economic growth on the one hand, and between labour productivity and unemployment on the other.

## **2. The Manufacturing Sector in Mauritius and South Africa**

The structure of the Mauritian economy has significantly changed in recent years, from a heavy focus on agriculture to the services sector and industry. The share of the agriculture, forestry and fishing sector in the GDP has dropped. Manufacturing has also experienced a fall but was still above many comparator countries in Southern Africa. In fact, manufacturing continues to play a prominent role in the Mauritian economy, contributing an average of 20.8 percent to GDP between 1980 and 2013 (Table 1 and Figure 1). The sector comprises mainly production of sugar, food (excluding sugar), textile and others for export to the European Union (EU) and other markets. However, it is the services sector that dominates the economy, contributing 64 percent to GDP in 2000 and 72.2 percent in 2013.

**Table 1: Percentage Contributions of Selected Sectors to Mauritian GDP**

Sector	2006	2007	2008	2009	2010	2011	2012	2013
Agriculture, hunting, forestry and fishing	5.6	4.8	4.3	4.3	3.6	3.6	3.4	3.4
Mining and quarrying	0.1	0.0	0.0	0.0	0.4	0.4	0.3	0.3
Manufacture	20.0	19.8	20.1	19.5	17.0	16.9	16.7	16.5
Sugar	0.9	0.7	0.6	0.5	0.3	0.4	0.3	0.3
Food (excluding sugar)	5.6	5.9	7.1	7.2	6.0	6.0	6.6	6.5
Textile	6.6	0.5	5.4	4.9	5.3	5.1	4.9	4.8
Other	7.0	6.7	7.0	7.0	5.4	5.4	4.9	4.9

Source: Mauritian Bureau of Statistics, 2013

The country places a high premium on high-tech manufacturing geared towards both domestic and export markets. More specifically, the Mauritian Government through the 2014 budget measures introduced an investment tax credit scheme to spur high-tech manufacturing. From 2007 to 2013, labour productivity in the manufacturing sector registered an average annual growth rate of 3.3 percent – consistent with the improvement in labour productivity index in recent years from 100.0 in 2007 to 121.8 in 2013 (Republic of Mauritius, 2013).

The manufacturing sector in South Africa continued to show resilience, contributing an average of 19.4 percent to GDP between 1980 and 2013 (Figure 2). Umjwali (2012) noted that South African manufacturing increased in dollar terms from \$30.8 billion in 1990 to \$44.4 billion in 2010 (in constant 2005 prices), but South Africa's share of world manufacturing output decreased from 0.61 percent in 1990 to 0.5 percent in 2010.

**Table 2: Shares of GDP – South African Economy, 2004-2013**

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Agriculture, value added (% of GDP)	3	3	3	3	3	3	3	2	3	2
Services, etc., value added (% of GDP)	66	66	66	66	65	66	67	68	69	70
Industry, value added (% of GDP)	31	31	31	31	32	31	30	30	28	28
Manufacturing, value added (% of GDP)	19	18	17	17	17	15	14	13	12	12

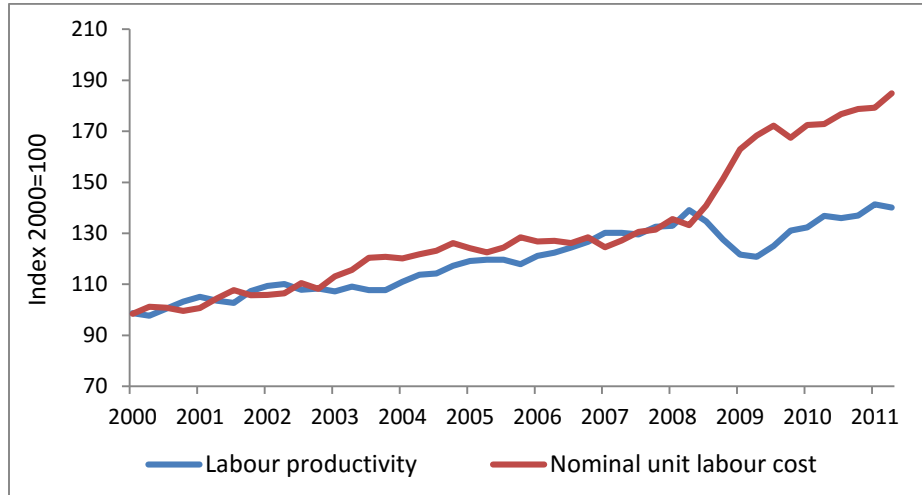
Chemicals (% of value added in manufacturing)	6	6	7	7	6	7	7			
Food, beverages and tobacco (% of value added in manufacturing)	16	17	18	18	19	20	22			
Textiles and clothing (% of value added in manufacturing)	5	4	4	4	3	3	2			
Machinery and transport equipment (% of value added in manufacturing)	14	15	15	14	13	14	14			
Other manufacturing (% of value added in manufacturing)	59	58	56	58	59	56	55			

Source: World Development Indicators

Manufacturing contribution to GDP in South Africa consistently declined between 2004 and 2013 (Table 2). However, there were wide variations among individual sectors that constitute the manufacturing sector in the country. For example, the value added of chemicals to manufacturing was 6 percent in 2004 before marginally rising to 7 percent in 2010. Food, beverages and tobacco's value added to manufacturing was 16 percent in 2004 and then jumped to 22 percent in 2010. Textiles and clothing's value contribution to manufacturing was 5 percent in 2004 before dipping to 2 percent in 2010. Machinery and transport provided a value to manufacturing of 14 percent in 2004 and six years later in 2010 it was still at 14 percent. Other manufacturing activities' contribution to overall manufacturing was a notable 59 percent in 2004 before registering a decline of 4 percent to 55 percent in 2010. However, the services and industry sectors took a lion's share in terms of contribution to GDP between 2004 and 2013. Notably, services contributed 66 percent to GDP in 2004 before peaking at 70 percent in 2013.

Generally, labour productivity has been on the rise in South Africa since 2000, save for 2008 when the economy was adversely affected by the pass-through effects of the global financial and economic crises (Figure 2). Several factors account for rising labour productivity, including job shedding in industry, as the economy opened up to global trade at the end of apartheid, and differences in the rate of increase in employment which is slower than overall output growth. The country has also invested heavily in education and skills development to reverse the legacy of apartheid education policies, which are said to be responsible for the diverse unemployment rates across various race groups, with whites having an average unemployment rate of close to 5 percent, compared to the national average of around 25 percent, whilst that of blacks/Africans is approximately 30 percent (IDC, 2013).

**Figure 2: Labour Productivity and Nominal Unit Labour Cost in South Africa (2000-2011)**



Source: Adapted from Umjwali (2012), using data from the SA Reserve Bank

### **3. Literature on Labour Productivity and Economic Growth**

Several studies have attempted to explain sources of growth and determinants of labour productivity in developing countries. Ahmed (2011) analysed the effects of labour productivity, capital deepening and total factor productivity in ASEAN5 (Malaysia, Indonesia, Philippines, Singapore and Thailand) plus 3 (China, Japan and South Korea) and concluded that there was a slight contribution of total factor productivity (TFP) intensity to economic growth.<sup>6</sup> He noted that capital intensity had a strong and significant impact on labour productivity in the concerned countries. Wu (2013) used output and employment indicators for 33 industries in China over a period of 21 years and noted that the Chinese economy achieved nearly a fourfold growth in labour productivity averaging 6.6 percent per annum. These findings are consistent with Bosworth and Collins (2007), who earlier established that China's high growth performance is attributable to a very high rate of capital accumulation and from gains in TFP, while that of India is as a result of more substantial gains in TFP relative to capital accumulation.

Fedderke and Bogetic (2009) explored whether infrastructure investment is an influential factor of economic growth, using a panel of South African manufacturing sectors over the 1970-2000 period. They concluded that infrastructure had both a direct impact on output per worker and an indirect impact via total factor productivity. Of the 19 categories of infrastructure, road infrastructure has a very strong impact on labour productivity. However, they also found that the skills ratio of manufacturing employment was consistently negative and significant. They cited measurement problems for the human capital input as a

<sup>6</sup> ASEAN is the Association of Southeast Asian Nations consisting of Brunei Darussalam, Cambodia Indonesia, Laos PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam.



probable explanation, but also highlighted the history of underinvestment in human capital as another explanation, implying that industries with a strong human capital requirement have not been able to hire the required workers.

Svirydzenka and Petri (2014) used a standard growth accounting framework to assess drivers of growth in Mauritius over the past 60 years, and used results to project growth until 2030. Their findings include a declining contribution of labour, with capital and TFP playing a dominant role. However, the contribution of labour improves with investment in education over the assessment period. They also noted that labour regulations were a constraint to job creation and structural mobility of labour across sectors. They recommended upgrading and expanding of the country's capital stock (infrastructure) to improve competitiveness and for further increases in economic growth through deregulation of labour laws to attract high skilled foreign labour, reforms of pensions and social benefits, and policies to increase fertility.

Ding and Knight (2009) used a panel of 146 countries, including China, to examine the extent to which the rapid growth of China and the huge gap in the growth rate between China and other countries can be explained by the augmented Solow model. They argued that human capital can raise the individual productivity of workers and improve adaptability, allocative efficiency and the technical level of an economy. For instance, Ding and Knight (2009) noted that the average years of schooling in China over age 15 (5.6 years) were higher than that of South Asia (3.1 years) and sub-Saharan Africa (2.9 years). They also found that China's relative success in economic growth is due to high physical capital investment, conditional convergence gain, dramatic changes in the structure of employment and output and low population growth.

Studies in developed countries draw similar conclusions, but have superior data for analysing the link between technology, innovation and productivity. For example, Griffith et al. (2006) applied a structural model that describes the link between R&D expenditure, innovation output and productivity for manufacturing firms in France, Germany, Spain and the UK. The model was used to explain whether EU's poor performance lies in low investment in R&D or elsewhere. They found heterogeneity between countries, but the determinants of R&D were similar. Comparable processes drive firm decisions to engage in R&D, government funding plays an important role in all countries, with national funding having the greatest impact, and firms that operate in international markets are more likely to engage in formal R&D, as are firms in industries where greater use is made of formal or strategic methods to protect innovation. They concluded that product innovators devote more effort to R&D and are stimulated by customers while process innovators have higher investment per worker with suppliers providing valuable information.

Thus, the literature and empirical evidence strongly suggest that labour productivity plays a significant role in the determination of economic growth across countries and is worth investigating further. Distinctively, endogenous growth models take capital as an input in production technology for innovation and long-run differences in productivity are



seen as endogenous, while growth accounting approaches focus on the role of technological efficiency in determining economic growth. In our study we consider technological change and investment as inseparable, hence the need to incorporate structural change variables in the augmented Solow model to capture the role of both factor accumulation and productivity growth in international variations on output growth.

#### 4. Estimation Method and Results

There are various ways of specifying a growth accounting framework, depending on data and estimation methods available. The most common approach based on the Solow model (neoclassical framework) is a standard Cobb-Douglas production function relating output (Y) to capital (K) and labour (L), assuming constant returns to scale.

$$Y = AK^{\alpha}L^{1-\alpha} \quad (1)$$

Given this specification, total factor productivity (A) is expressed as a residual (exogenous) since the only data available are for output, labour and capital. Thus the change in output is decomposed as follows:

$$\frac{dY}{Y} = \frac{dA}{A} + \alpha \frac{dK}{K} + (1-\alpha) \frac{dL}{L} \quad (2)$$

The basic Solow model does not adequately explain the sources of growth as it only highlights the role of saving and capital accumulation. Alternative specification based on endogenous growth theory focuses on explaining sources of technological progress, and highlights human capital, skills and knowledge as drivers of growth (Arrow, 1962; Romer, 1989). An empirical workhorse representing a compromise between the two approaches is the augmented Solow model which includes both technology and human capital accumulation. In addition, our model is based on a continuous time economy and thus allows us to differentiate the aggregate production function with respect to time, which in turn yields more information than many growth models.

In this paper we followed Ahmed's (2011) estimation procedure, which is based on a standard production relating output to labour, capital and other inputs.<sup>7</sup> The analysis is based on aggregate data obtained from the World Bank World Development Indicators (WDI). The data on working age population (15-64 age group), real GDP, savings, investment and employment shares (for agriculture, industry and services) were obtained from the 2013 edition of WDI.

Our innovation includes estimating a simple regression for each country based on the Solow growth model as presented in equation 1. The results were used to obtain the

---

<sup>7</sup> See Appendix 1 for a detailed mathematical specification of the model.

elasticity of output with respect to inputs and exogenous technical progress estimates for each country. We then proceeded to estimate equation 1 in Appendix 1 using a pooled generalised least squares regression, where output per worker is treated as a dependent variable. We assume the unobserved panel-level effects are correlated with the lagged dependent variables, making standard estimators inconsistent.

Our findings (Table 3) suggest that in both Mauritius and South Africa saving, which is a proxy for investment in physical capital, has a strong positive effect on labour productivity and economic growth. This is consistent with both the neoclassical and endogenous growth models. Capital accumulation benefits labour particularly in sectors requiring skilled employees. The effect of exogenous technological progress on the two economies is, however, negative and highly significant. The low coefficient suggests that new technologies not only impact on labour productivity negatively, but also that the rate at which new technologies impact on labour productivity is too slow. Both countries face a labour skills gap that fails to match technology advancement, hence the cumulative effect of exogenous technology on labour productivity is negligible in the three year intervals. In other words, economic growth in the two countries is driven by accumulation of traditional inputs of labour and capital and to some extent, exogenous technical progress, which masks the quality aspects of the traditional inputs, particularly labour productivity.

Our results are comparable to Dao (2014), who found that the growth rate of per capita GDP is linearly dependent on technological progress, gross capital formation, the initial level of output per capita and labour productivity growth, measured as the growth rate of the value added per worker, as well as human capital formation, measured as the growth rate of the average number of years of formal schooling among all persons aged 15 and above. The results are also supported by Felix and Anna-Elizabeth (2013) and Andrew Jia-Yi (2014), who noted strong performance in growth due to intensity in labour productivity.

**Table 3: Econometric Results**

Dependent variable: Output per worker	Coefficient	Standard error	z	P> z
$y_{i,t-1}$ (lagged output per worker)	0.918	0.038	24.070	0.000
$\ln(s)$ (saving rate)	0.124	0.036	3.450	0.001
$\ln(n + g + \delta)$ (Change in productive capacity represented by growth rate of the labour force, technical progress and depreciation of physical capital)	0.253	0.051	5.000	0.000
$\ln A - \ln A_0$ (exogenous technical progress)	-0.027	0.008	-3.210	0.001
Employment in industry (% of the total)	-0.320	0.230	-1.390	0.163

Constant	-0.362	0.306	-1.180	0.237
Wald chi2(5)	4819.54			
Prob> chi2	0.000			
Number of observations	44			

Unlike Ding and Knight (2009), we found a consistent positive relationship between population growth (the labour force in our case) and output per worker. The accumulation of labour force is good for both economies as it raises productivity. For Mauritius, this result renders support to the policy of attracting skilled labour to fill gaps as the country invests in preparing young Mauritians for high-skilled jobs. In the case of South Africa, accumulation of labour is beneficial only moderately, and on sector basis, particularly in manufacturing where the high capital input offsets low labour productivity. Consistent with the Solow model, South African manufacturing depicts a typical positive relationship between output and labour at low levels of capital or technology input before diminishing returns set in. This may not hold in neoclassical models that assume steady state equilibrium, since the relationship between output per worker and population growth is expected to be negative, occasioned by the ease with which new technologies may be diffused within a lower workforce.

Our results are also indicative of structural factors that determine labour productivity. For instance, the simultaneous inclusion of the share of employment in industry proves that a high share of labour employment in industry has a negative impact on the output per worker. Although the variable is not significant, the negative relationship indicates the presence of strong structural issues in the labour market that impact on labour productivity and employment. In the case of South Africa there is a mismatch between specialised skills needed in the labour markets and those being produced by the educational system, thus leading to structural unemployment in the economy, while Mauritius has a fairly high pool of specialised skills needed for its labour market. Thus the study takes note of these fundamental differences, including differences in initial technological endowments, the role of political and economic institutions as drivers of growth and the quality of the labour force.

We also found that a lower value of output in the three year intervals is associated with a lower output per worker and vice versa. This is consistent with the intuitive conclusion above that both countries are not yet at their steady state output and that output per worker drives economic growth. Most importantly, unlike studies that conclude that capital accumulation is an inferior source of growth due to diminishing returns, our results suggest that capital deepening is still important for economic growth in Mauritius and South Africa. In particular, with technology or capital accumulation outstripping human capital

growth rate, it is both the initial stock and the subsequent accumulation of human capital that stimulate faster output growth.

## **5. Conclusion**

This paper aimed to explain the sustained economic growth in Mauritius and South Africa and how labour productivity impacts on economic growth. It also sought to find the probable explanation for the discrepancies in manufacturing and unemployment rates, given that industries in both economies have consistently performed well in recent years.

The growth of the labour force has been positive for general economic growth in both Mauritius and South Africa. We argue, however, that high-quality skilled labour is needed to maintain productivity and economic growth. Although labour productivity has important implications for GDP growth, our findings in this paper suggest that unemployment is a consequence of cumulative skills mismatch as the economies experienced industry-led growth rather than an increase in structural unskilled labour supply. This explains why a high share of employment in industry is detrimental to labour productivity, particularly in South Africa. This implies that both countries should place emphasis not just on keeping unemployment low, but also on skills development efforts to improve labour productivity, particularly in industry.

The quality of labour employment will be important for sustaining growth of productivity. In this context, apprenticeship and reskilling of the labour force through appropriate training to increase productivity is highly recommended in both countries. Unlike many studies that conclude that capital deepening is not very critical to output growth, the findings in this study point to the need to match the level of technological development with skills accumulation. We particularly take note that technological change and investments are inseparable and hence the need to incorporate structural change variables in the augmented Solow model to capture the role of both factor accumulation and productivity growth.

We also recommend sustainable investments in research and development in both countries, with a special focus on upgrading technology to boost labour productivity. More importantly, we conclude that it is both the initial stock and subsequent accumulation of human capital that stimulates faster output growth in both Mauritius and South Africa.

## **References**

Arrow, K.J. (1962). "The Economic Implications of Learning by Doing." *The Review of Economic Studies* 29(3): 155-73.

Ahmad, H.K., M.I.T. Mahmood and M. Afzal. (2010). "Exploring the Effect of Total Factor Productivity Growth on Future Output Growth: Evidence from a Panel of East Asian Countries." *Pakistan Economic and Social Review* 48(1): 105-22.

Ahmed, E.M. (2011). "Measuring the Effects of Labour Productivity on ASEAN5 Plus3 Economic Growth." *Journal of Business Management and Economics* 2(2): 69-74.

Andrew Jia-Yi, A. (2014). "Revisiting the Productivity Growth and Spillovers Debate: The Case of the Malaysian Manufacturing Sector." *Journal of the Asia Pacific Economy* 19(4): 656-81.

Banerjee, A.V., S. Galiani, J. Levinsohn, Z. McLaren and I. Woolard. (2008). "Why has Unemployment Risen in the New South Africa?" *Economics of Transition* 16(4): 715-40.

Bosworth, B. and S.M. Collins. (2007). "Accounting for Growth: Comparing China and India." *NBER Working Paper Series*, Working Paper 12943, Cambridge, MA USA.

Campbell, H.F. (2009). "Measuring the Contributions of Education to Labour Productivity in a Developing Economy." *International Journal of Education Economics and Development* 1(2): 156-65.

Chan, M.W.L. and D.C. Mountain. (1987). "Measuring Contributing Factors to Interregional Agricultural Labour Productivity Differentials: A Joint Profit Formulation." *Journal of Regional Science* 27(2): 269-81.

Dao, M.Q. (2014). "Drivers of Economic Growth in Developing Countries." *Journal for Studies in Economics and Econometrics* 38(1): 75-85.

Ding, S. and J. Knight. (2009). "Can the Augmented Solow Model Explain China's Remarkable Economic Growth? A Cross-Country Panel Data Analysis." *Journal of Comparative Economics* 37: 432-52.

ECA and AU. (2014). *Economic Report on Africa 2014*. Dynamic Industrial Policy in Africa, Addis Ababa, Ethiopia.

ECA and AU (2013). *Economic Report on Africa 2013*. Making the Most of Africa's Commodities: Industrializing for Growth, Jobs and Economic Transformation, Addis Ababa, Ethiopia.

- Fedderke, J.W. and Z. Bogetic. (2009). "Infrastructure and Growth in South Africa: Direct and Indirect Productivity Impacts of 19 Infrastructure Measures." *World Development* 37(9): 1522-39.
- Felix, R. and T. Anna-Elizabeth. (2013). "Intangible and Labour Productivity Growth: Panel Evidence for the EU from 1998-2005." *Review of Income and Wealth* 59(3): 486-508.
- Fosse, H.B., J. Jacobsen and R.H. Jacobsen. (2014). "The Short-Run Impact of Total Factor Productivity Growth of the Danish Innovation and Research Support System." Centre for Economic and Business Research (CEBR): Copenhagen, Denmark.
- Griffith, R., E. Huergo, J. Mairesse and B. Peters. (2006). "Innovation and Productivity across Four European Countries." *Oxford Review of Economic Policy* 22(4): 483-98.
- Hall, R.E. and C.I. Jones. (1999). "Why Do Some Countries Produce So Much More Output per Worker than Others?" *The Quarterly Journal of Economics* 114(1): 83-116.
- Highfill, K. (2002). "The Economic Impacts of Increased Labour Productivity: A REMI Analysis of Increased Output in Missouri's Chemical Sector." Department of Economic Development, Missouri Economic Research and Information Centre, MO USA.
- IDC. (2013). "South African Economy: An Overview of Key Trends since 1994." Industrial Development Corporation. Johannesburg: South Africa.  
<http://www.idc.co.za/reports/IDC%20R&I%20publication%20-%20Overview%20of%20key%20trends%20in%20SA%20economy%20since%201994.pdf>
- Kazuya, O. (2009). "Long Working Hours in Japan: An International Comparison and Research Topics." *Japanese Economy* 36(2): 23-45.
- Kim, J-II and L. Lau. (1994). "The Sources of Economic Growth of the East Asian Newly Industrialized Countries." *Journal of Japanese and International Economics* 8: 235-71.
- Konstantinos, C. and T. Vangelis. (2014). "Human Capital Contributions to Explain Productivity Differences." *Journal of Productivity Analysis* 41(3): 399-417.
- Mankiw, N.G., D. Romer and D.N. Weil. (1992). "A Contribution to the Empirics of Economic Growth." *The Quarterly Journal of Economics* 107(2): 407-437.

Palle, A., J. Dwyer and G. David. (1995). "Productivity and Growth." Proceedings of a Conference Held at the H.C. Coombs Centre for Financial Studies, Kirribilli, Australia.

Prescott, E.C. (1997). "Need: A Theory of Total Factor Productivity." Federal Reserve Bank of Minneapolis and University of Minnesota, USA.

Republic of Mauritius. (2013). "Digest of Productivity and Competitiveness Statistics." Ministry of Finance and Economic Development. Statistics Mauritius, Port Louis, Mauritius.

Republic of South Africa. (2013). "Statistical Release P0441: Gross Domestic Product, Annual Estimates 2003-2012, Regional Estimates 2003-2012 and Third Quarter 2013." Pretoria, South Africa.

Romer, P.M. (1989). "Human Capital and Growth: Theory and Evidence." Paper Prepared for the April 1989 Carnegie-Rochester Conference. University of Chicago, USA.

Svirydzenka, K. and M. Petri. (2014). "Mauritius: The Drivers of Growth – Can the Past be Extended?" IMF Working Paper WP/14/132. IMF African Department.

Solow, R.M. (1956). "A Contribution to the Theory of Economic Development." *Quarterly Journal of Economics* 70: 65-94.

Umjwali. (2012). "Research on the Performance of the South African Manufacturing Sector." the Small Enterprise Development Agency.

World Bank. (2011). "Fostering Technology Absorption in Southern African Enterprises." The World Bank, Washington D.C., USA.

Wu, H.X. (2013). "Measuring Industry Level Employment, Output and Labour Productivity in the Chinese Economy, 1987-2008." *Economic Review* 64(1): 42-61.



## Appendix 1: The Econometric Method

We follow Ahmed's (2011) estimation procedure and use a standard production as follows:

$$Y_{i,t} = f(K_{i,t}, L_{i,t}, T_{i,t}) \quad (1)$$

Where for country  $i = 1, 2$  (Mauritius and South Africa) in year  $t = 1990-2010$ ,  $Y$  is the GDP adjusted for purchasing power parity and the inputs are: fixed physical capital  $K$ , number of persons employed  $L$  (or number of hours worked to capture labour productivity) and time  $T$ , proxies total factor productivity (TFP) or technological progress of the two countries.

Following Ding and Knight (2009) and ignoring country specific subscripts, the dynamics of a country's growth rate towards the steady state can be expressed as the logged difference of the output per worker at time  $t$  and at some initial date:

$$\ln \frac{Y_t}{L_t} - \ln \frac{Y_0}{L_0} = -\theta \ln \frac{Y_0}{L_0} + \theta \frac{\alpha}{1-\alpha} \ln(s) - \theta \ln(n + g + \delta) + \theta \ln A_0 + g_t \quad (2)$$

Where  $n$  is the exogenous growth rate of labour,  $A$  is technical progress (growing at rate  $g$ ),  $A_0$  is the initial level of efficiency,  $s$  is the constant fraction of output that is saved and invested,  $\delta$  is the depreciation rate of physical capital,  $\alpha$  is the elasticity of output with respect to physical capital,  $\theta = 1 - e^{-\tau t}$ , where  $\tau$  is the rate of convergence measured as  $\tau = (1 - \alpha)(n + g + \delta)$ .

For estimation, the output per worker at three year intervals beginning with 1990, 1993, 1996, and 2011, can be expressed as in the equation below:

$$\Delta y_{i,t} = (\alpha - 1)y_{i,t-1} + x'_{i,t}\beta + \gamma_t + v_{i,t} \quad (3)$$

Where  $\Delta y_{i,t}$  is the log difference in real GDP per worker over the three year interval,  $y_{i,t-1}$  is the logarithm of the real GDP per worker at the beginning of each period,  $x_{i,t}$  is the vector of other explanatory variables measured either at the beginning of each period or averaged over the 3-year interval,  $\gamma_t$  is the time dummy reflecting productivity changes common to both countries, and  $v_{i,t}$  is the error term.

The vector of other explanatory variables  $x_{i,t}$  includes physical capital to account for changes in productive capacity, human capital accumulation to account for employment effects of productivity, and structural change variables to account for differences in economic structure between the two countries. The structural variables are proxied by the industry share of total employment.

## Appendix 2: Trends in Output and Inputs in Mauritius

**Table 4: Trends in Output and Inputs in Mauritius – Total Economy, 2002-2012**

(Index 2007 = 100)

Year	Real output		Labour input		Capital input	
	Index	Growth rate (%)	Index	Growth rate (%)	Index	Growth rate (%)
2002	78.7	1.6	94.2	0.2	77.7	4.8
2003	83.6	6.3	95.3	1.2	82.0	5.6
2004	87.2	4.3	96.3	1.0	86.3	5.2
2005	89.6	2.7	96.8	0.6	90.0	4.3
2006	94.6	5.6	98.4	1.6	94.8	5.4
2007	100.0	5.7	100.0	1.6	100.0	5.5
2008	105.5	5.5	103.7	3.7	105.2	5.2
2009	108.8	3.1	104.2	0.5	111.1	5.7
2010	113.3	4.2	106.6	2.3	116.8	5.1
2011	117.3	3.5	106.9	0.3	122.4	4.8
2012	121.2	3.3	108.6	1.6	127.7	4.3
<b>Average annual growth rate 2002 - 2012</b>	4.4%		1.4%		5.1%	

Source: Mauritian Bureau of Statistics